

Application No. 10/628,738
Amendment dated June 29, 2007
Reply to Office Action of April 4, 2007

AMENDMENTS TO THE CLAIMS:

The listing of claims replaces all prior versions and listings of claims in the application:

LISTING OF THE CLAIMS

1. (Currently amended) A method in a resource deallocation module of releasing resources of a user session operating in a software environment that includes an automatic memory management algorithm executed by a garbage collector, the method comprising:

using the resource deallocation module, detecting an impending execution of the automatic memory management algorithm by the garbage collector for removing a session object created for the user session, wherein said session object of the user session is not referenced by a remaining object and which does not reference one or more external resources;

responsive to the detecting, accessing, by the resource deallocation module, an said session object of the user session and traversing an object graph;

identifying, by the resource deallocation module, one or more obsolete external resource references of said session object, wherein said one or more obsolete external resource references have not been released by said session object;

using the resource deallocation module, releasing said one or more obsolete external resource references by a set of rules for said session object; and

repeating the accessing, identifying, and releasing, by the resource deallocation module, for each session object of the user session.

2. (Original) The method as set forth in claim 1, further including:
performing the accessing, identifying, releasing, and repeating as a Listener method belonging to a Java MyListener class in a Java environment; and
registering the Listener method with the user session.

3. (Original) The method as set forth in claim 2, wherein the registering

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includes:

setting a session attribute to correspond to an instance of the Listener method.

4. (Original) The method as set forth in claim 2, wherein the detecting includes:

notifying the registered Listener method of the impending expiration of the user session.

5. (Original) The method as set forth in claim 1, wherein the detecting includes:

detecting an impending expiration of the user session.

6. (Original) The method as set forth in claim 1, wherein the accessing, identifying, releasing, and repeating is performed prior to the execution of the automatic memory management algorithm.

7. (Original) The method as set forth in claim 1, wherein:
the identifying includes identifying a file resource; and
the releasing includes closing said file resource.

8. (Original) The method as set forth in claim 1, wherein:
the identifying includes identifying an allocated resource; and
the releasing includes deallocating the allocated resource.

9. (Currently amended) The method as set forth in claim 1, wherein the accessing of an said session object of the user session includes:

obtaining an object identifier corresponding to said session object from the object graph; and

retrieving said object using the object identifier.

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10. (Withdrawn) An article of manufacture comprising a program storage medium readable by a computer and embodying one or more instructions executable by the computer to perform a method for preparing a user session for expiration, the method including:

detecting an impending expiration of the user session;

traversing an object graph corresponding to the user session to locate user session objects;

for each object located in the traversing, identifying allocated resources of the object; and

for each identified allocated resource, deallocating said allocated resource.

11. (Withdrawn) The article of manufacture as set forth in claim 10, wherein the identifying includes:

identifying resources selected from a group consisting of file handles, database connections, sockets, and threads.

12. (Withdrawn) The article of manufacture as set forth in claim 10, wherein the traversing, locating, identifying, and deallocating is completed prior to execution of a garbage collection algorithm performed preparatory to expiration of the user session.

13. (Withdrawn) The article of manufacture as set forth in claim 10, wherein the one or more instructions are encoded as one of:

Java bytecodes,

C# intermediate language (IL) code,

A compiled Java program, and

a compiled C# program.

14. (Withdrawn) The article of manufacture as set forth in claim 10, wherein the traversing of the object graph includes:

obtaining an enumeration of user session objects; and

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looping through the enumeration of user session objects.

15. (Currently amended) A system comprising:

a software program configured to initiate, process, and terminate user sessions;

an object graph defining an interrelationship between objects of said user session;

a resource deallocation module linked to the software program to deallocate obsolete allocated external resources of each object of one or more objects created for a user session responsive to an impending termination of said user session, wherein said obsolete allocated external resources have not been released by said object; and

an automatic memory management garbage collector module invoked subsequent to the deallocation performed by the resource deallocation module for removing each of said one or more objects which is not referenced by a remaining of said one or more objects and which does not reference one or more of said allocated external resources.

16. (Original) The system as set forth in claim 15, further including:

a Java virtual machine implementing the software program, the resource deallocation module, and the automatic memory management module.

17. (Original) The system as set forth in claim 15, wherein the resource deallocation module includes:

a deallocation listener method adapted to deallocate the allocated external resources of each object of said user session responsive to a notification of the impending termination of said user session.

18. (Original) The system as set forth in claim 17, wherein the resource deallocation module is linked to the software program by registration of the deallocation listener method with said user session.

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19. (Original) The system as set forth in claim 17, wherein the resource deallocation module is linked to the software program by an assignment of an attribute of said user session to the deallocation listener method.

20. (Previously Presented) The system as set forth in claim 15, wherein the resource deallocation module is adapted to access the object graph to identify the objects of the user session.

21. (Original) The system as set forth in claim 15, wherein the automatic memory management module is invoked by the software program to process a plurality of user sessions including said user session.

22. (Original) The system as set forth in claim 15, wherein the automatic memory management module is invoked by an operating system to process software including said software program that operate under said operating system.

23. (Original) The system as set forth in claim 15, wherein the resource deallocation module is integrated with the automatic memory management module as a single unitary memory management unit that executes prior to the termination of said user session.

24. (Currently amended) An article of manufacture comprising a program storage medium readable by a computer and embodying one or more instructions of a resource allocation module executable by the computer to perform a method of releasing resources of a user session operating in a software environment that includes an automatic memory management algorithm executed by a garbage collector, the method comprising:

using the resource deallocation module, detecting an impending execution of the automatic memory management algorithm by the garbage collector for removing at least one session object created for the user session, wherein said object of the user

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session is not referenced by a remaining object and which does not reference one or more external resources;

responsive to the detecting, accessing, by the resource deallocation module, an said session object of the user session and traversing an object graph;

identifying, by the resource deallocation module, one or more obsolete external resource references of said session object, wherein said one or more obsolete external resource references have not been released by said session object;

using the resource deallocation module, releasing said one or more obsolete external resource references by a set of rules for said session object; and

repeating the accessing, identifying, and releasing, by the resource deallocation module, for each object of the user session.

25. (Previously presented) The article of manufacture as set forth in claim 24, wherein the method further includes:

performing the accessing, identifying, releasing, and repeating as a Listener method belonging to a Java MyListener class in a Java environment; and

registering the Listener method with the user session.

26. (Previously presented) The article of manufacture as set forth in claim 25, wherein the registering includes:

setting a session attribute to correspond to an instance of the Listener method.

27. (Previously presented) The article of manufacture as set forth in claim 25, wherein the detecting includes:

notifying the registered Listener method of the impending expiration of the user session.

28. (Previously presented) The article of manufacture as set forth in claim 24, wherein the detecting includes:

detecting an impending expiration of the user session.

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29. (Previously presented) The article of manufacture as set forth in claim 24, wherein the accessing, identifying, releasing, and repeating is performed prior to the execution of the automatic memory management algorithm.

30. (Previously presented) The article of manufacture as set forth in claim 24, wherein:

the identifying includes identifying a file resource; and
the releasing includes closing said file resource.

31. (Previously presented) The article of manufacture as set forth in claim 24, wherein:

the identifying includes identifying an allocated resource; and
the releasing includes deallocating the allocated resource.

32. (Previously presented) The article of manufacture as set forth in claim 24, wherein the accessing of an object of the user session includes:

obtaining an object Identifier corresponding to said object from the object graph;
and
retrieving said object using the object identifier.

33. (Previously presented) The method as set forth in claim 1, further including:

identifying said object of the user session; and,
determining an object type of said object.

34. (Previously presented) The method as set forth in claim 33 wherein said releasing includes releasing said one or more external resource references by a set of rules for said object, including rules based on said object type.

35. (Previously presented) The method as set forth in claim 1, wherein

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said one or more external resource references are associated with at least one of file handles, database connections, sockets, and threads.

36. (Currently amended) A method in a resource deallocation module of releasing resources of a user session operating in a software environment that includes an automatic memory management algorithm executed by a garbage collector, the method comprising:

using the resource deallocation module, detecting an impending execution of the automatic memory management algorithm by the garbage collector for removing at least one session object created for the user session, wherein said at least one session object of the user session is not referenced by a remaining object and which does not reference one or more external resources;

responsive to the detecting, accessing, by the resource deallocation module, a said session object of the user session;

identifying, by the resource deallocation module, one or more obsolete external resource references of said session object, wherein said one or more obsolete external resource references have not been released by said session object;

using the resource deallocation module, releasing said one or more obsolete external resource references by a set of rules for said session object; and

repeating the accessing, identifying, and releasing, by the resource deallocation module, for each session object of the user session.

37. (Previously presented) The method as set forth in claim 36, further including:

identifying said object of the user session; and,
determining an object type of said object.

38. (Previously presented) The method as set forth in claim 37 wherein

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said releasing includes releasing said one or more external resource references by a set of rules for said object, including rules based on said object type.

39. (Currently amended) A system comprising:

a software program configured to initiate, process, and terminate user sessions;

a resource deallocation module linked to the software program to deallocate obsolete allocated external resources of each object of a user session responsive to an impending termination of said user session, wherein said one or more obsolete allocated external resources have not been released by said object; and

an automatic memory management garbage collector module invoked subsequent to the deallocation performed by the resource deallocation module for removing each of said one or more objects which is not referenced by a remaining of said one or more objects and which does not reference one or more of said allocated external resources.

40. (Currently amended) An article of manufacture comprising a program storage medium readable by a computer and embodying one or more instructions of a resource allocation module executable by the computer to perform a method of releasing resources of a user session operating in a software environment that includes an automatic memory management algorithm executed by a garbage collector, the method comprising:

using the resource deallocation module, detecting an impending execution of the automatic memory management algorithm by the garbage collector for removing a session object created for the user session, wherein said session object of the user session is not referenced by a remaining object and which does not reference one or more external resources;

responsive to the detecting, accessing, by the resource deallocation module, a said session object of the user session;

identifying, by the resource deallocation module, one or more obsolete external

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resource references of said session object, wherein said one or more obsolete external resource references have not been released by said session object;

using the resource deallocation module, releasing said one or more obsolete external resource references by a set of rules for said session object; and

repeating the accessing, identifying, and releasing, by the resource deallocation module, for each session object of the user session.

41. (Currently amended) The article of manufacture as set forth in claim 40, wherein the method further includes:

identifying said session object of the user session; and,
determining an object type of said session object.

42. (Previously presented) The article of manufacture as set forth in claim 41, wherein the method further includes releasing said one or more external resource references by a set of rules for said object, including rules based on said object type.